

4.1 Extreme values of functions

local vs global extreme values

local min/max refers to a local neighborhood

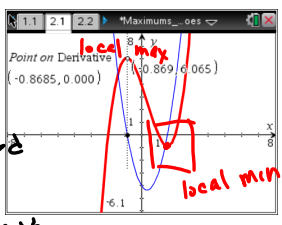
global refers to the whole graph

critical points, endpoints candidates for max/min

1. $f'(x) = 0$

2. $f'(x) = \text{undefined}$

3. endpoint



Oct 18-8:47 AM

find extrema of $f(x)$ on $[2,3]$. Solve graphically and analytically

Define $f(x) = x^3$ on $[-8, 8]$

$f'(x) = \frac{2}{3}x^{-\frac{1}{3}} = \frac{2}{3\sqrt[3]{x}}$

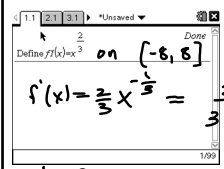
1. $f' = \frac{2}{3\sqrt[3]{x}} = 0$ no values of x

2. $f' = \frac{2}{3\sqrt[3]{x}} = \infty$ $x=0$ $y=0$

3. endpoints $x=8$ $y=4$
 $x=-8$ $y=-4$

max at $x=8$ $y=4$
or $x=-8$ $y=-4$

min at $x=0$ $y=0$



Oct 18-8:51 AM

find extrema of $f(x)$. Solve graphically and analytically

Define $f(x) = \frac{1}{\sqrt{4-x^2}} = (4-x^2)^{-1/2}$ Done

$x=2$ $x=-2$ $(-2, 2)$

✓ no endpoints

$f'(x) = -2x(-\frac{1}{2})(4-x^2)^{-3/2} = \frac{x}{\sqrt{(4-x^2)^3}}$

✓ $f'(x) = 0$ if $x=0 \rightarrow y = \frac{1}{2}$ min

✓ $f'(x) = \infty$ $x=2$ $x=-2$ not in domain

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Define $f(x) = \begin{cases} 5-2x^2, & x \leq 1 \\ x+2, & x > 1 \end{cases}$ Done

$f'(x) = \begin{cases} -4x, & x < 1 \\ 1, & x > 1 \end{cases}$

$f'(1)$ is undefined candidate

$x=1$ $y=3$ min is $y=3$

$x=0$ $y=5$ max is $y=5$

$(0,5)$ $(1,3)$

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$-4x = 1$
at $x=1$
 $-4 \neq 1$

Oct 18-9:00 AM

Define $f(x) = \ln\left(\frac{x}{1+x^2}\right)$ Done

Oct 18-9:01 AM